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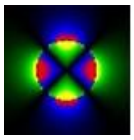
Magnet Division Specification

Specification Number: SMD-APUL-2010

Revision: A



Superconducting Magnet Division

Procurement Specification, APUL D1 Yoke Laminations, Iron Phosphate Coating

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Revision History

- Rev A:

1 Scope:

This specification gives the procedure for applying an iron phosphate coating to APUL yoke laminations made from ultra low carbon magnet steel. The purpose of this surface treatment is to improve the corrosion resistance of the laminations.

2 Applicable Documents:

N/A

3 Processing Requirements:

3.1 Pre-Inspection:

Laminations shall first be inspected for corrosion, scale, or damage. Parts exhibiting any of these three conditions shall be rejected.

3.2 Set-Up:

Laminations shall be loaded/hung in a manner which will not cause damage and will give the parts the maximum exposure possible during cleaning and phosphating.

3.3 Surface Cleaning/Chemical Conversion Coating (Iron Phosphate):

The purpose is to remove oils, greases, and soil while depositing a thin adherent iron phosphate coating on the metal surface. Laminations shall be subjected to an aqueous solution containing 12-15% phosphoric acid or acid phosphate salts with or without the addition of accelerating agents until a uniform insoluble phosphate coating is produced which has a color varying from golden yellow to purple. The temperature of the solution shall be maintained at 145-160 deg. F. Laminations should be exposed to the phosphating solution in a spray process for at least 1 minute or 3 minutes in an immersion process.

3.4 Fresh Water Rinse:

Cleaning/Phosphating shall be followed by a fresh water rinse at ambient temperature in order to remove any remaining salts or unreacted phosphating materials.

3.5 Final Chromic Acid Rinse:

The final rinse process shall be a chromic acid solution at a concentration not exceeding 3% at a temperature of 100-180 deg F. Additional pertinent process controls including recommendations for replenishment and discarding shall be designated by the supplier of the final rinse chemicals.

3.6 General Requirements:

3.6.1 Appearance:

Iron phosphate coating deposits shall be continuous, uniform in texture, and evenly deposited over all surfaces of the lamination. The coating shall be golden yellow to purple in color. There shall be no smut, powder, corrosion products, or white stains due to dried phosphating solutions remaining on the lamination. There shall be a minimum number of contact marks on the laminations from racks or holders.

3.6.2 Coating Weight:

Iron phosphate minimum weight shall be 25 mg/sq ft (270 mg/m^2). Unless otherwise specified by the Buyer, the coating weight shall be tested at least every four hours.

4 Quality Assurance Provisions:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract, the Seller (contractor performing the phosphating operation) is responsible for the performance of all inspection requirements as specified herein. Except as may otherwise be specified in the contract, the Seller may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved of by Buyer. The Buyer reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to the prescribed requirements.

4.2 Test Methods:

Tests shall be conducted as required in this specification. The right is reserved by the Buyer to make any additional tests deemed necessary to determine that the process meets the requirements of this specification.

4.2.1 Test Specimens:

Test specimens shall be prepared from actual production laminations or if size is prohibitive, from sections cut from scrap parts of the same kind and finish (from the same manufacturing lot if possible) which have been rejected for causes other than phosphating, material composition, or any combination thereof. Test specimens need not be identical in shape or size but shall be stamped, etched, or otherwise indelibly marked for identification as a test specimen. All test specimens shall be processed through all the cleaning, rinsing, phosphating, and drying steps along with the production articles being processed.

4.2.2 Removal of Soils and Corrosion Products:

Following the final rinse, at least two specimens, at the conclusion of a maximum of each four hours of production, shall be dried and examined visually for rust, corrosion products, and soils. If the surface shows signs of soils or corrosion products, all laminations processed since last acceptance shall be rejected and corrective action taken. After corrective action, testing shall be continued at least once every hour until there is no sign of soils or corrosion products. Testing frequency shall then revert to two test specimens at the conclusion of a maximum of each four hour production interval.

4.2.3 Final Rinse:

The final chromic acid rinse shall be tested, replenished and discarded in accordance with procedures designated by the suppliers of the final rinse chemicals.

4.2.4 Phosphating Controls:

4.2.4.1 Phosphate Coating Weight:

Three test specimens (see paragraph 4.2.1), at the conclusion of a maximum of each four hours of phosphate processing shall be selected by the inspector for the test. The clean, dry specimens shall be accurately weighed and the surface area of each calculated. The phosphate coatings shall be completely removed by immersion in a 5 percent (by weight) chromic acid solution at 165^0F for 15 minutes, rinsed, dried and weighed. This process shall be continued until constant weight is attained. A new chromic acid solution shall be used for each repeat immersion. The coatings weight shall be determined from the formula:

Coating weight (mg/ft^2) = $\frac{\text{(Initial weight in gms - Final weight in gms) x 144,000}}{\text{Total surface area in square inches}}$

$g/m^2 = \frac{\text{(Initial weight in grams - final weight in grams)}}{\text{Total surface area in square meters}}$

Four hours production shall be considered acceptable provided the average coating weight of the three specimens equals or exceeds the minimum coating weight required for the applicable type and not more than one sample falls below the minimum. The sample falling below the minimum shall be within ten percent of the minimum requirement. If two or more specimens fail to comply with the minimum coating weight, the four hours production shall be reworked and corrective action taken until production is again acceptable. When determining the surface area of irregularly shaped objects, consideration and care should be taken to correctly determine the surface area of both the inner and outer surfaces of the test piece.

4.2.4.2 Free and Total Acid Process Controls:

A free and total acid titration control shall be conducted after every four hours of processing as verification for compliance with supplier's recommendation.

4.3 Non-Conforming Articles: Laminations coated in a manner which does not fully meet the requirements of this specification and the purchase order shall not be offered to the Buyer.

5 Preparation for Delivery:

N/A